SOLID WASTE TECHNICAL GUIDANCE
REDUCING OR TERMINATING GROUNDWATER MONITORING
AT SOLID WASTE LANDFILLS

Summary: The Department has developed this guidance for landfill owners and operators considering reducing or terminating monitoring at solid waste landfills. It describes how requests should be prepared and criteria the Department will use in reviewing those requests. This guidance replaces previously released guidance for reducing monitoring frequency near landfills, published in the October 1997 "Solid Waste Technical Guidance", Vol. No. 97-2.

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Introduction

To reduce the risk of groundwater contamination and to protect present and future groundwater use, the Department of Natural Resources requires periodic groundwater monitoring near many landfills. Prior to 1996, routine monitoring normally occurred every 3 months (quarterly). Since 1996, the normal sampling frequency for newer landfills, with current design features, has been every 6 months (semiannually). Although administrative codes have changed, a landfill owner or operator must continue to monitor each landfill according to its approved plan until the Department formally approves any changes in the monitoring frequency.

This guidance covers three types of modifications to a facility's monitoring schedule:

- Reductions in frequency from quarterly to semi-annually.
- Reductions in frequency to less than semi-annually.
- Termination of monitoring.

In general, reductions of monitoring frequency from quarterly to semi-annual are possible at any type of landfill unless conditions, such as a release of contaminants from the facility, would require more frequent monitoring. Reductions in frequency to less than semi-annual are less likely to be approved, and may not be permitted for some types of facilities (see "Applicability" below). Finally, termination of monitoring may be possible only under rare circumstances where the volume and type of waste, hydrogeologic conditions,

and long term groundwater monitoring have shown that the facility does not, and will not, pose a threat to human health or the environment.

This guidance only addresses how to propose changes in monitoring frequency. It does not address changes in sampling parameters, sampling procedures, adding or replacing wells, etc. You may propose such changes at the same time you propose to reduce monitoring frequency.

Applicability to General Categories of landfills

Different types of landfills may have differing monitoring requirements, depending on which provisions of the Wisconsin Statutes or Administrative Code apply. A landfill will fall into one of the following general categories:

- Subtitle D Landfills. These are landfills that accepted municipal solid waste on or after October 9, 1993. (However, if a landfill received less than 100 tons per day on an annual basis, it is not a Subtitle D Landfill unless it accepted municipal solid waste on or after April 9, 1994.) Subtitle D landfills are subject to Wisconsin rules consistent with federal RCRA solid waste landfill regulations (see 40 CFR, parts 257 and 258). The minimum groundwater monitoring frequency for active or closed Subtitle D landfills is semi-annual (NR 507, Appendix I, Table 1, Wis. Adm. Code).

- Small or Intermediate Size Construction and Demolition Waste (C & D) Landfills. Small size C & D landfills are landfills for disposal of no more than 50,000 cubic yards of construction and demolition waste. Intermediate size C & D landfills are designed for disposal of more than 50,000 cubic yards but no more than 250,000 cubic yards of construction of demolition waste. These are regulated under ss. NR 503.09 and NR 503.10, Wis. Adm. Code, respectively. The minimum monitoring frequency for each is semi-annual. It is important to note that, because they are regulated under ch. NR 503, the Department does not have authority under the rule to reduce monitoring frequency to less than semi-annual for either a small or intermediate size C & D landfill.

- "Other Non-Subtitle D Landfills"(see NR 507.15(1) and NR 507.19, Wis. Adm. Code):
  - Construction and demolition waste landfills greater than 250,000 cubic yards.
  - Industrial waste landfills.
  - Municipal waste landfills that ceased accepting municipal solid waste prior to October 9, 1993, including both approved and non-approved landfills.
  - Municipal waste landfills which received less than 100 tons per day on an annual basis and which ceased accepting solid waste prior to April 9, 1994.

This guidance has been written regarding routine groundwater monitoring of solid waste landfills. Although the principles in this guidance may apply to landfills undergoing remediation, the Department will review the monitoring programs at remediation sites on a case-by-case basis.

Technical Recommendations about Monitoring Frequency

Based on current regulations, it is not possible to reduce monitoring to less than semi-annual or to terminate monitoring at Subtitle D landfills or the small and intermediate size construction and demolition waste landfills. Therefore, this part of the guidance is directed at the types of landfills listed in the previous section under "Other non-subtitle D Landfills". (The principles discussed below would also apply to the first two general categories of landfills if the proposal is to drop frequency from quarterly to semi-annual.)

The minimum monitoring frequency in ch. NR 507, Wis. Adm. Code, is semi-annual. However, under s. NR 507.19(2), Wis. Adm. Code, the Department may approve other sampling frequencies in writing. Although it is legally possible to reduce monitoring, the Department's technical staff recommend the following: (For a tabular presentation of the following monitoring frequencies, see Appendix A.)

1. The Department recommends that most landfills monitor groundwater semi-annually, as is required in administrative codes for today's state-of-the-art landfills. The Department may require more frequent monitoring depending on waste type(s), size, design, the physical environment or existing groundwater contamination (see NR 507.19(2), Wis. Adm. Code).. Quarterly and semi-annual frequencies give the best picture of trends in groundwater quality over time. The Department recommends that industrial landfills monitor groundwater at least semi-annually due to the waste volumes, waste types and potential for groundwater contamination.

2. Assuming the general criteria for reducing monitoring (next section) are met, the Department may determine that it is appropriate to reduce groundwater monitoring frequencies from semi-annual to annual. Monitoring frequencies less than annual are generally not sufficient to protect public health and the environment. Increasing trends in contaminants in groundwater may take too long to detect, especially if one or more samples were skipped or determined to be unreliable. Monitoring well maintenance and sample quality can decline if the well is sampled less than annually. In addition, for small municipal landfills on an annual budget cycle, monitoring less than once a year might be left off the budget during the "off" year and be forgotten thereafter.

3. The Department believes termination of monitoring is inappropriate for landfills. The only and very rare exceptions would be near landfills where future groundwater contamination is extremely unlikely. An example of such circumstances would be where all of the following are true:

    - The landfill accepted only municipal solid waste,
    - The landfill volume is very small,
    - The geologic and hydrogeologic conditions near the landfill would be suitable to prevent contamination migration (for example, groundwater is far removed from waste, soils are finer-grained and would inhibit contaminant movement, etc.),
    - Groundwater sampling results would demonstrate that any concentrations exceeding NR 140 groundwater standards or preventive action limits are due to background conditions, or that contaminant levels have decreased or stabilized at a low level and do not pose a threat to human health of the environment, and
    - The Department determines that NR 140 groundwater standards will not be exceeded beyond the Design Management Zone (defined in s. NR 140.22(3), Wis. Adm. Code) in the future.

The Department will evaluate proposals to terminate monitoring even more cautiously than proposals to reduce monitoring. Discontinuing monitoring and removing monitoring wells seriously complicates the future ability to determine whether a closed landfill is the source of groundwater contamination. Most closed landfills are located in areas where residents rely or may someday rely on private wells for water. A landfill that seems isolated now may be surrounded by homes and wells in the future. Furthermore, most landfills that closed before 1993 have design inadequacies that increase the potential for groundwater contamination -- such as, no liner, no leachate collection, groundwater near the waste, and highly permeable soils. Finally, the wording "alternative frequencies" in s. NR 507.19(2), Wis. Adm. Code, implies that some monitoring is required. Therefore, requests to terminate monitoring should be very rare and approved only based on the facts of each case.

General Criteria for Reducing or Terminating Monitoring

Landfill owners or operators requesting reduction or termination of groundwater monitoring should demonstrate all of the following.

- That a reduction or termination of monitoring does not present a threat to public health and welfare or the environment. The Department will review the landfill history, hydrogeology and monitoring data.
- That the facility has an adequate monitoring network. This means that a sufficient number of wells are in locations and at depths needed to detect groundwater contamination near the landfill and the wells were constructed properly and are in good condition. If this is not the case at your landfill, you should upgrade and repair the wells before submitting your request to reduce monitoring. If you are unsure, ask for a preliminary review (see "How to propose changes in monitoring frequency," below).
- That the data submitted to the Department are reliable and complete. This includes maps, well locations, well construction logs, groundwater monitoring data and other information. In particular, the Department will carefully evaluate data on volatile organic compounds (VOCs) to determine data reliability (see Appendix D "Quality Assurance Considerations for VOCs".) If data are unreliable, you will have to take more samples before the Department can review your request.
- That no significant groundwater contamination is evident. Any ONE of the following would be evidence of significant groundwater contamination:
  - Sample results which exceed preventive action limits (PALs) defined in NR 140 for Public Health Standards repeatedly. Note: repetitive Public Welfare Standard exceedances will be reviewed on a case-by-case basis.
  - Significant detection of VOCs in the groundwater after the landfill has been closed for a minimum of 5 years. This time limit may be increased if an analysis of the flow system shows that groundwater moves very slowly and therefore contaminants may not have reached the monitoring wells yet.
  - Significant differences in water quality when comparing upgradient or background wells with down gradient wells, where the difference cannot be reasonably attributed to other factors, such as soil/rock type, natural variability or other sources of groundwater contamination.

These are not legal requirements, but are set out because they will assist the Department in evaluating requests for reduction or termination of monitoring frequency and in most cases increase the probability they can be granted.

CAUTION:

A request to reduce monitoring may lead to increased monitoring!

The process of preparing and reviewing a request to reduce or terminate monitoring may disclose unanticipated conditions, such as groundwater contamination or an inadequate well network. These conditions may lead to increased monitoring requirements, an environmental investigation, or remediation of the landfill.

How to propose changes in monitoring frequency

The Department must approve changes in monitoring before you implement them. Here are some things you should know about proposing changes in monitoring frequency.

Preliminary Reviews The Department strongly recommends that you contact the Department hydrogeologist assigned to your facility for a preliminary review of your proposal before spending time and money compiling the information needed for a formal plan modification request. (Department staff assigned to your area are listed on the Department's Internet web site, at http://www.dnr.state.wi.us.) You may already have much of the necessary information in reports previously prepared for the site. However, for some closed sites, records are incomplete or outdated, and you should provide the information in Appendix B for the Department to review. The Department will provide a preliminary review and opinion. There is no fee for the preliminary review.

Plan Modifications If your plan of operation, groundwater monitoring plan or closure plan specifies a specific monitoring frequency, you must obtain written Department before you implement any change of monitoring. To initiate the approval process, you must submit a formal plan modification request to the Department for approval to amend this plan pursuant to s. 289.30(6), Stats.. All submittals must follow the general submittal requirements detailed in s. NR 500.05, Wis. Adm. Code, regarding the contents, format, number of copies, size of visuals, etc. For a detailed listing of the information to be submitted with your plan modification request, please refer to Appendix C.

Upon receiving your plan modification proposal, the Department will send an invoice to cover the cost of reviewing the plan, based on the plan review fees listed in s. NR 520, Wis. Adm. Code, Table 3. As of the date of this guidance, the plan review fee is $1500 for most landfills and $150 for landfills with only a closure plan approved under NR 514, Wis. Adm. Code. No fees are required for expedited plan modifications, which are discussed below. Fees are subject to change, so be sure to consult the most recent version of the chapter NR 520, Wis. Adm. Code.

Expedited Plan Modifications Wisconsin's solid waste rules outline a process by which certain plan modifications may be submitted to the Department. If the Department does not object within thirty days after it receives the expedited proposal, the proposed modifications are considered to be approved automatically (see s. NR 514.09, Wis. Adm. Code).

Except as noted below, the expedited plan modification process may apply to reductions of monitoring frequency from quarterly to semi-annual at a landfill where it is determined by the Department to pose low potential risk of adverse impacts on public health or the environment. The information to be submitted under the expedited plan modification process is the same as for a formal plan modification and is listed in Appendix C.

The expedited plan modification is not applicable to the following proposals:

- Proposals to change monitoring at small and intermediate size construction and demolition waste landfills, because these landfills are regulated under ch. NR 503, not ch. NR 514, Wis. Adm. Code.
- A change that would result in a violation of a statute or administrative rule, or an existing written condition contained in a department approval document, and would require issuance of an exemption by the Department.

In addition, the Department may object to proposals which do not pose a low potential risk to public health or the environment under s. NR 514.09(1)(a)13., Wis. Adm. Code, including:

- Proposals that would reduce monitoring frequency to less than semi-annually or would terminate monitoring. These are considered to be high-risk because of the potential for closed landfills to cause groundwater contamination and to affect nearby drinking water supplies.
- Complex proposals, that is, a single proposed plan modification which includes multiple requests. For example, you may propose to change the monitoring parameters, approve preventive action limits, grant exemptions to groundwater standards or change other aspects of sampling and landfill operation at the same time you request a reduction in monitoring frequency. These more complicated proposals take longer to review and should be submitted as formal plan modifications rather than expedited plan modifications.

Based on s. NR 514.09(1)(a)13., Wis. Adm. Code, it is likely that the Department would object to the above proposals for expedited plan reviews.

In any case, you should contact the DNR Hydrogeologist assigned to your facility prior to submitting a proposed expedited plan modification. There are no plan review fees for plans approved under the expedited plan review process. If the Department objects and you choose to submit a formal plan modification, you will be charged the appropriate plan review fee.

DISCLAIMER

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Appendix A
Groundwater Monitoring Frequencies for Various Landfill Categories

Landfill Type	Applicable Code Provisions	Legally Possible Monitoring Frequencies	Technically Recommended Monitoring Frequencies	Expedited Plan Review may be used to reduce to:
Subtitle D Municipal landfills	NR 507.15(2), and NR 507.19, Wis. Adm. Code	Semi-Annual. Federal Subtitle D regulations specify semi-annual.	Semi-annual or quarterly	Semi-annual
Small Size Construction & Demolition Waste landfills (Less than or equal to 50,000 c.y.)	NR 503.09(5), Wis. Adm. Code	Semi-annual. Other frequencies not allowed.	Semi-annual or quarterly	Not Allowed
Intermediate Size Construction & Demolition Waste landfills (More than 50,000 c.y. but less than or equal to 250,000 c.y.)	NR 503.10(7), Wis. Adm. Code	Semi-annual. Other frequencies not allowed.	Semi- annual or quarterly	Not Allowed
Large Size Construction & Demolition Waste landfills (More than 250,000 c.y.)	NR 507.15(1), and NR 507.19, Wis. Adm. Code	Semi-annual. DNR may approve other frequencies.	Semi-annual or quarterly	Semi-annual
Industrial landfills	NR 507.15(1), and NR 507.19, Wis. Adm. Code	Semi-annual. DNR may approve other frequencies.	Semi-annual or quarterly	Semi-annual
Non-Subtitle D Municipal landfills (see "Applicability" for description)	NR 507.15(1), and NR 507.19, Wis. Adm. Code	Semi-annual. DNR may approve other frequencies.	Semi-annual or quarterly	Semi-annual

**In rare cases, where the landfill meets the criteria in this guidance, annual monitoring may be appropriate. In extremely rare cases, monitoring may be terminated.

Appendix B
Information to Provide With a Request for a Preliminary Review

When you ask the Department for a preliminary opinion on the potential to reduce or terminate monitoring at your facility, you should submit the following information for Department review:[1]

1. A description of your proposed monitoring program and how it differs from your existing monitoring program. Presentation in a table is preferred.

   Note: The Department recommends monitoring of volatile organic compounds (VOCs) along with standard field measurements such as water elevation, conductivity (i.e., specific conductance), alkalinity and hardness temperature and pH. Monitoring of VOCs provides a direct measurement of representative toxic compounds that may be released by a landfill. Appendix D outlines quality assurance considerations for VOC samples.

   Note: The Department is reconsidering the usefulness of chemical oxygen demand (COD) [acronym is defined in s. NR 500.03(37)] as a monitoring parameter for certain landfills and waste types, because the test results may be highly variable and the analysis method itself generates a mercury waste. If COD does not appear to be a useful parameter at your landfill and if your current monitoring program includes sampling for VOCs, the Department may consider dropping COD from your list of required monitoring parameters and may add a substitute parameter such as Dissolved Organic Carbon (DOC). In some cases it may be acceptable to add VOCs and drop COD.

2. An evaluation of the monitoring network at the site, with specific attention given to:
   a. the positioning of the up-gradient and down-gradient wells,
   a. the condition of the wells, and
   a. identification of any repairs or improvements needed to ensure that the monitoring network is capable of accurately characterizing groundwater quality as it might be affected by the facility.

3. A current, adequately-scaled map that accurately depicts all of the following:
   a. The waste boundaries of the landfill;
   b. The location of all monitoring wells;
   c. The location of all private water supply wells within 1200 feet of the landfill;
   d. The location of all public water supply wells and high-capacity wells within one-half mile of the landfill;
   e. Relevant surface water features (such as wetlands within 300 feet and navigable waters within 1000 feet);
   f. The location of any structures on or near (within 300 feet of) the landfill; and
   g. The zoning of land within 1200 feet of the landfill and a key describing allowed uses under the current zoning ordinance.

4. Any information on monitoring of VOCs at the landfill, such as the last time such testing was performed, how often samples were analyzed and all results of VOC testing and quality assurance information. If VOCs have been monitored routinely, summarize the historical trends, list values exceeding groundwater standards, and discuss how the samples meet the quality assurance considerations in Appendix D.

5. Any other information that you believe is relevant to your request or that may update information in the Department's files. All data not already sent to the Department must be submitted on diskette in proper uploadable format.

The Department will base its opinion on the likelihood of reducing or terminating groundwater monitoring on the above information and previously-submitted monitoring results.

[1] These are not legal requirements, but are set out because they will assist the Department in evaluating requests for reduction or termination of monitoring frequency and in most cases increase the probability they can be granted

Appendix C
Information to Provide With A Plan Modification Request to Reduce or Terminate Monitoring

Reduction of monitoring should not be requested if evidence of groundwater contamination is shown by should probably state "enforcement standards" and "preventive action limits" as defined in ch. NR 140 when using these terms, only "PAL" has been defined in the guidence text] ES exceedances, increasing PAL exceedances, or a history of volatile organic chemicals (VOCs) being detected.

If you choose to pursue a formal plan modification or expedited plan review to reduce the sampling frequency at your facility, you should prepare the plan according to the general submittal requirements in s. NR 500.05, Wis. Adm. Code and this Appendix.

Please submit all of the following information with your request to reduce monitoring to semi-annual.[2] If any of the information is in reports you have already submitted to the Department, you may refer to those reports. However, if any referenced report does not accurately reflect current conditions, you must describe the current conditions and update plan sheets, if necessary.

1. A description of the landfill, including:
   a. landfill size, that is, the number of acres filled
   b. depth of waste below ground surface
   c. volume of waste disposed (including daily cover)
   d. waste types
   e. years of operation
   f. history of operation and ownership
   g. whether or not waste was burned at the site
   h. landfill design, including any liner and leachate collection systems
   i. time since closure
   j. type and thickness of final cover
   k. depth to groundwater
   l. soil types
   m. distance to monitoring wells
   n. distance and direction to water supply wells
   o. distance to surface water and wetlands
   p. distance to buildings

2. An up-to-date, adequately-scaled map that depicts:
   a. the facility's property boundaries
   b. the zoning of the land within 1200 feet of the landfill
   c. all private water supply wells within 1200 feet of the landfill
   d. all public water supply and high-capacity wells within one-half mile.

3. Up-to-date, adequately-scaled groundwater table contour maps of the site, showing all of the following:
   a. the limits of waste filling
   b. the location of all monitoring wells
   c. the location of surface water features such as wetlands, streams and lakes
   d. the elevation of the static water table

[2] These are not legal requirements, but are set out because they will assist the Department in evaluating requests for reduction or termination of monitoring frequency and in most cases increase the probability they can be granted

e. groundwater contours (equipotential lines)
f. perpendicular streamlines indicating groundwater flow direction.

4. Separate plan sheets depicting:
   a. the high water table
   b. the low water table
   c. maximum variance in ground water flow direction. Indicate the maximum variation in flow direction based on the historical groundwater elevation data collected at the site. Indicate the flow direction at the high and low water table elevations based on the historical groundwater elevation data collected at the site.

5. An analysis of the 3-dimensional groundwater flow system at the site, including an estimate of groundwater velocity. Show your calculations.

6. Copies of well and boring logs for the monitoring wells on the site, indicating the geologic characteristics and the depth and screened interval of each well.

7. An analysis of all historic groundwater monitoring data to characterize groundwater quality and identify any trends.
   a. Describe the monitoring history, including the number of samples collected to date, how the samples were collected for various parameters, detection limits used, compliance with monitoring requirements, what quality assurance/quality control (QA/QC) samples were taken and an interpretation of QA/QC results. See also Appendices D and E.
   b. Assess landfill impacts by comparing background or upgradient groundwater conditions to downgradient conditions and by plotting concentrations vs. time for the wells. Please note that an increasing trend in concentration is not the only indicator of groundwater contamination. Most computer spreadsheet programs offer simple graphing and least-squares regression routines to determine whether a statistical trend exists in a data set.
   c. Answer these questions: Is the landfill contaminating groundwater? Yes, no or maybe? If maybe, what information is needed to determine if it is or isn't?

8. Results from 2 rounds of samples obtained within the past 2 years and analyzed for the VOCs and dissolved substances associated with landfill leachate listed in Appendix E. Samples should be taken to meet the quality assurance considerations listed in Appendix D. These samples should be obtained from each groundwater monitoring well at the landfill and each private, high capacity, and public water supply well within 1200 feet sidegradient or downgradient from the landfill. The wells should be sampled three to six months apart to account for seasonal variations. The data must be submitted on diskette in proper uploadable format.

9. A copy of an affidavit of site registry (Form #4400-67, available from the Department's Bureau of Waste Management at 608-266-2111) showing that the landfill's existence has been recorded in the county Registrar of Deeds' office. This is an official deed notice to inform future property owners of the existence of the solid waste landfill.

10. If you are proposing a reduction in monitoring frequency, a description of your proposed monitoring program and how it differs from your approved monitoring program. The proposed monitoring program should specify the frequency of sampling, wells and parameters to be sampled and the month(s) sampling will be conducted.

    Note: The Department strongly recommends monitoring of VOCs along with standard field measurements such as water elevation, specific conductance (conductivity), hardness, alkalinity,

temperature and pH. Monitoring of VOCs provides a direct measurement of representative toxic compounds that may have been released by a landfill.

Note: The Department is reconsidering the usefulness of COD as a monitoring parameter for certain landfills and waste types, because the test results may be highly variable and the analysis method itself generates a mercury waste. If COD does not appear to be a useful parameter at your landfill and if your current monitoring program includes sampling for VOCs, the Department may consider dropping COD from your list of required monitoring parameters and may add a substitute parameter such as Dissolved Organic Carbon (DOC). In some cases it may be acceptable to add VOCs and drop COD.

11. If you are proposing to monitor indicator parameters, you should calculate NR 140 preventive action limits (PALs) for all indicator parameters, except pH and temperature, for all wells using the latest guidance for calculating PALs and alternative concentration limits ACLs. (see also NR 140.20, Wis. Adm. Code). This guidance is available from the Department by calling 608-266-2111. If you are proposing to monitor only VOCs, you do not need to calculate PALs.

12. Certification that a professional geologist has prepared the report according to s. NR 500.05(4)(b), Wis. Adm. Code.

REQUESTS TO REDUCE TO ANNUAL MONITORING OR TO TERMINATE MONITORING

If you are submitting a plan modification to reduce monitoring frequency to annual or to terminate monitoring, you should submit all of the above items plus the additional information listed below.

13. Results from 4 rounds of samples obtained within the past 2 years and analyzed for the VOCs and dissolved substances associated with landfill leachate listed in Appendix E. Samples should be taken to meet the quality assurance considerations listed in Appendix D. These samples should be obtained from each groundwater monitoring well at the landfill and each private, high capacity, and public water supply well within 1200 feet sidegradient or downgradient from the landfill. The wells should be sampled three to six months apart to account for seasonal variations. Data must be on diskette in proper uploadable format. (You may include the 2 rounds required in item 8 above.)

14. Results of hydraulic conductivity testing to support your estimate of groundwater flow velocity and travel time to the nearest downgradient well.

15. A discussion of the potential for development of, and new water supply well installations on, land within 1200 feet of the landfill.

Appendix D:
Quality Assurance Considerations
for Volatile Organic Compounds (VOCs)

Your landfill's groundwater monitoring program may have been approved before the importance of VOC sampling was recognized. Therefore, there may be little or no VOC data for the Department to review along with your request to reduce or terminate monitoring. Depending on the type of reduction desired, you may need to gather more VOC samples before you submit your plan modification to the Department. Given the very limited amount of VOC data being requested and the importance of the decision being made, it is essential that the both the VOC sampling and the analyses be reliable. If samples are collected improperly or the quality of sampling results is poor, the data may be unusable. If so, the Department will require you to take more samples.

We strongly encourage you to incorporate data quality expectations into your contracts for services. This appendix will guide you in your selection of laboratories and consultants.

Sampling

The preferred sample collection method is low flow pumping; however, other methods may be acceptable. Using bailers for collecting samples is not an appropriate choice of sampling method because of the high probability that VOCs will be lost in the sampling process. The DNR *Groundwater Sampling Desk Reference* (PUBL-DG-037-96) [available at http://www.dnr.state.wi.us/org/water/dwg/gw/GW-SDR-A.PDF] describes various methods for collecting groundwater samples with their advantages and limitations. Flawed sampling techniques may mean that the sample results obtained are not representative. Additional sampling and analyses may be necessary to make a defensible decision.

Laboratories typically supply sample bottles, preservatives, and shipping instructions. For VOC samples to be valid, the bottle must be filled completely with no air space remaining. The samples must be cooled immediately. We strongly encourage using cubed ice to cool the samples rather than "blue ice" or other ice packs, which do not cool samples below 4 degrees Celsius (40 degrees Fahrenheit). If samples are not sufficiently cooled, the analysis may be invalid and additional sampling may be needed. Remember to include one trip blank per cooler.

Analyses

In selecting a laboratory for these analyses, consider the following credentials and capabilities:

Currently certified or registered for Volatile Organics under chapter NR 149, Wis. Adm. Code [WAC];
Methods used are capable of detecting VOCs below the ch. NR 140, Wis. Adm. Code, Preventative Action Limits (PALs), except as noted in the discussion below;
Blanks demonstrate that laboratory contamination is under control;
Ability to report quality control data (surrogates, matrix spikes, duplicates, blanks);
Quality control recoveries within 70 – 130%.

Certification

Laboratories should be able to provide a copy of their certificate that lists their certifications. In addition, you may obtain a list of certified laboratories from the Laboratory Certification page on the DNR web site (http://www.dnr.state.wi.us/org/es/science/lc/search/.

Method Detection Limits for VOCs

As you select a laboratory, consider whether their VOC method is capable of detecting the target substances below their respective PALs. Laboratories should be able to provide a list of their method detection limits. The laboratory selected should have detection limits of 0.2 µg/L or below for the list of volatiles. Based on a survey of laboratories in the certification program, about half of the laboratories are capable of meeting these expectations. The following substances have PALs below 0.2 µg/L:

Substance	CAS Number	PAL (µg/L)	Target MDL (µg/L)
Bromodichloromethane	75-27-4	0.06	0.15
1,3-Dichloropropene(cis & trans)	10061-01-5		
	10061-02-6	0.02	0.15
1,1,2,2-Tetrachloroethane	79-34-5	0.02	0.15
Vinyl chloride	75-01-4	0.02	0.15

DNR recognizes that few laboratories are capable of achieving detection limits below the PALs for these substances. Our laboratory survey suggests that about 25% of certified laboratories can achieve detection limits of 0.15 µg/L for these substances and so we suggest this be the target detection limit for the above substances. Remember that s. NR 507.26, Wis. Adm. Code, requires all results be reported to the laboratory's method detection limit, even in cases where the laboratory's method detection limit is lower than the PAL.

Blanks

Field and laboratory method blanks provide an indication of whether sampling and analysis have contaminated the samples. Several of the volatiles found in contaminated groundwater are common laboratory contaminants. Ideally, the method blanks that laboratories analyze with samples should be free of contaminants; however, in reality laboratories have varying degrees of success in their efforts to control contamination. Methylene chloride is one of the most problematic contaminants. For results to be useful, methylene chloride contamination in method blanks should be less than 0.2 µg/L. If contamination in method blanks or field blanks exceed 0.5 µg/L (i.e. the PAL), additional monitoring may be necessary. Less commonly found contaminants include benzene, acetone, methyl ethyl ketone, ethyl benzene, toluene, and xylenes. The laboratory certification code, section NR 149.14(3)(d), Wis. Adm. Code, provides guidelines on acceptable levels of contamination. Contamination in excess of 5% of the sample concentration significantly reduces the reliability of the result and may make the result unusable.

Quality Control Results

As a routine quality control practice, laboratories monitor the recoveries of surrogate standards in each sample. The recovery of the surrogates is an indicator of the reliability of the results for the target compounds. When you are selecting a laboratory, we recommend that you closely examine quality control limits. For groundwater, recoveries for surrogates and matrix spikes should generally range between 70% and 130%. Although results outside of this guideline may be acceptable, the decreased reliability may mean that additional samples beyond the recommended number of rounds may be necessary to make a determination. Ask the laboratory to report quality control results along with the sample results.

Appendix E:
VOCs and Dissolved Substances Associated with Landfill Leachate

Common name	**Param. No.**	**CAS RN**	**Synonyms**
Acetone	81552	67–64–1	2–Propanone
Benzene	34030	71–43–2	Benzol, benzen, benzole
Bromodichloromethane	32101	75–27–4	Dichlorobromomethane
Bromoform	32104	75–25–2	Tribromomethane
Carbon disulfide	77041	75–15–0	Dithiocarbonic Anhydride
Carbon tetrachloride	32102	56–23–5	Tetrachloromethane
Chlorobenzene	34301	108–90–7	Monochlorobenzene
Chloroethane	34311	75–00–3	Ethyl chloride
Chloroform	32106	67–66–3	Trichloromethane
Dibromochloromethane	32105	124–48–1	Chlorodibromomethane
1,2–Dibromo–3–chloropropane	38437	96–12–8	DBCP
1,2–Dibromoethane	77651	106–93–4	EDB; Ethylene dibromide
o–Dichlorobenzene	34536	95–50–1	1,2–Dichlorobenzene
m–Dichlorobenzene	34566	541–73–1	1,3–Dichlorobenzene
p–Dichlorobenzene	34571	106–46–7	1,4–Dichlorobenzene 8021, 8260
Dichlorodifluoromethane	34668	75–71–8	Freon 12, Difluorodichloromethane
1,1–Dichloroethane	34496	75–34–3	
1,2–Dichloroethane	32103	107–06–2	Ethylene dichloride
1,1–Dichloroethylene	34501	75–35–4	Vinylidene chloride
cis–1,2–Dichloroethylene	77093	156–59–2	cis–1,2–Dichloroethene
Trans–1,2–Dichloroethylene	34546	156–60–5	trans–1,2–Dichloroethene
1,2–Dichloropropane	34541	78–87–5	
cis–1,3–Dichloropropylene	34704	10061–01–5	cis–1,3–Dichloropropene, Z–Dichloropropylene
Trans–1,3–Dichloropropylene	34699	10061–02–6	trans–1,3–Dichloropropene, E–Dichloropropylene
Ethylbenzene	78113	100–41–4	Phenylethane
Methyl bromide	34413	74–83–9	Bromomethane
Methyl chloride	34418	74–87–3	Chloromethane
Methylene bromide	77596	74-95-3	Dibromomethane
Methylene chloride	34423	75–09–2	Dichloromethane
Methyl ethyl ketone	81595	78–93–3	2–Butanone; MEK
Methyl tert–butyl ether	78032	1634–04–4	MTBE
Naphthalene	34696	91–20–3	Camphor Tar, Naphthalin
Styrene	77128	100–42–5	Ethenylbenzene
Tetrachloroethylene	34475	127–18–4	Tetrachloroethene; Perchloroethylene; PCE; Perc
Tetrahydrofuran	81607	109–99–9	THF
Toluene	78131	108–88–3	Methylbenzene
1,1,1–Trichloroethane	34506	71–55–6	Methylchloroform
1,1,2–Trichloroethane	34511	79–00–5	
Trichloroethylene	39180	79–01–6	Trichloroethene; TCE

Trichlorofluoromethane	34488	75–69–4	Fluorotrichloromethane, Freon 11
Vinyl chloride	39175	75–01–4	Chloroethene
Xylenes (total)	81551	1330–20–7	Dimethylbenzene
Sulfate, dissolved	00946	14808-79-8	
Arsenic, dissolved	01000	7440-38-2	
Cadmium, dissolved	01025	7440-43-9	
Chromium, dissolved	01030	7440-47-3	Chrome
Lead, dissolved	01049	7439-92-1	Plumbum
Mercury, dissolved	71890	7439-97-6	Quick silver

Note: Xylenes (total): This entry includes o–xylene (CAS RN 96–47–6), m–xylene (CAS RN 108–38–3), p–xylene (CAS RN 106–42–3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330–20–7).

Source: Section NR 507, Wisconsin Administrative Code, Appendices III and IV